of general scientific knowledge, and of special knowledge in, at least, some one branch, as well as the necessity of a real passion for travelling, Prjevalsky adds :—"Moreover, he must be an excellent shooter, and, still better, a passionate hunter. He must not despise any hard manual work, as, for instance, the saddling of horses and camels, the packing of luggage, and so on—in short, he must never be a 'white-handed' person ; he must not have habits of luxury ; and he must have a pleasant, lenient character, which will soon acquire for him the friendship of his travelling companions." In these sentences he characterized himself. To renounce, if necessary, every comfort ; to live the life of the other members of the expedition, without any distinction between the scientific staff and the simplest soldiers or Cossacks ; to sleep in the same tent, to eat the same food, and to do the same work as the rest—such were Prjevalsky's rules. We must add also that, especially during his first two journeys, his relations with the natives were of the most friendly character. He carefully avoided any conflict with them ; and when it happened once, during his first journey, that the natives were hostile to him, and this hostility might have ended in an armed conflict, he preferred to win their respect by the following stratagem. He and his three men—all four admirable sharp-shooters—opened a fire from their breech-loading rifles upon the carcass of a horse, from a great distance. In two minutes they had discharged thirty bullets each, and they advised the Mongols to see if any bullet had touched the carcass. The Mongols rushed, of course, to the carcass, and, to their great astonishment, after hard work with their knives, discovered most of the 120 bullets in it. They did not fail, after this, to treat their visitors properly.

It is impossible to mention Prjevalsky's name without being reminded of his travelling companions. He himself so often expressed his gratitude to them, and he always wrote with so much sympathy about their common experiences, that we shall only be carrying out his wish in stating that Lieut. Pyevtsoff during Prjevalsky's first two journeys, Lieut. Roborovsky in the last two journeys, and M. Kozloff during the fourth, have their full share in what Prjevalsky modestly described as his "scientific reconnoitrings" in Central Asia. Their portraits, as well as his own, are given in his last work. P. K.

SMOKE IN RELATION TO FOGS IN LONDON.[1]

LONDON fogs are produced by the mechanical combination of particles of water with particles of coal or soot, and require for their fullest development the following conditions : a still air, a temperature lowest at or near the ground in comparison with an elevation of some hundreds of feet, saturation or partial saturation of the air within a moderate distance of the ground, absence of clouds overhead, and free radiation into space. The artificial darkness and peculiar colouring occur with greatest effect at times when a very large quantity of coal is being burnt in domestic fireplaces, and cannot as a rule prevail during the night between 10 p.m. and 5 a.m., or to any great degree in warm summer weather. The early hours of summer mornings are the only ones in which clear views of the whole city are possible. Next in clearness come fine Sunday afternoons in summer, when fires are allowed to go down. The hours of greatest density are those following the time of greatest cold on the earth's surface and of the lighting of large numbers of kitchen and other fires. Thus about 8 to 10 a.m. is frequently the period of thickest and darkest fogs. It may be noted that on Sundays, when factory fires are inoperative, fogs in winter have been densest ; on one Christmas Day there was absolute darkness during the whole day, thus showing the dependence of light-absorbing matter on kitchen and domestic fires. Many distinct conditions may alter the time of maximum density.

The formation of a London fog appears to take place as follows. An ordinary thick white fog covers the city, say at 6 a.m. ; about a million fires are lighted soon after this hour, and the atmosphere becomes charged with enormous volumes of smoke—that is, the gases of combustion bearing carbonaceous particles. Now, these particles, as soon as they are cooled to the temperature of the air, or below it, begin to attach to themselves the water spherules already present and visible, and vapour may also be condensed on the particles. A thick layer of these united particles prevents light from penetrating it, and a very small quantity of finely divided carbon may stop the bright sunshine altogether, like the film of soot on a smoked glass. The invariable redness of the sun through smoke seems to show that the majority of particles are comparable in diameter to the length of a wave of blue light. Smoke prevents the warmth of the oblique sunshine from reaching and evaporating the white fog near the ground, and the white fog continues to radiate towards space and towards the ground, if colder than itself, without receiving compensation from the solar rays. A difference of 10° has occasionally been noted between thermometers at 4 feet and 100 feet above the ground, the upper one always being the warmest in fogs. Carbon is a good radiator, and tends from this cause to keep itself cold by radiation into space, and thus to accumulate vapour from the air, like the dewy surface of the earth. The importance of a clear sky and a dry upper air in promoting fogs in this respect is obvious.

It has been supposed, quite erroneously as I believe, that, as even without any visible smoke an enormous quantity of fine invisible dust exists in the London atmosphere, the abolition of coal smoke would fail to give us freedom from dark fogs. Proof is altogether wanting that ordinary invisible dust in cities or plains is of a kind to create an abnormal amount of fog, or to produce those dismal obfuscations of which tarry carbon is capable. Paris, as long as it burnt wood and charcoal, was free from idiosyncratic fogs ; so are the wood and anthracite-burning cities of the United States ; and so are the towns of South Wales, where anthracite is the common fuel. If London were to cease using fuel in the solid form, it would be as free from fog as the surrounding country.

The accumulation which produces the worst and most dangerous fogs in London cannot, as a rule, proceed for many hours without disturbances arising which tend to reduce their importance. In winter the warmth of the air exceeds by 2° or 3° that of the surrounding country, consequently an upward current is started, which rises to some altitude, and then flows away, bearing with it a stream of murky cloud ; a circulation of air consequently takes place in the lower strata. If, however, the cold of the lower layers greatly surpasses that of the strata some hundreds of feet higher, and if the sun dissipates the fog in the surrounding country, thus making the environs warmer than London itself, the black fog may very likely remain on the town all day. For this reason, on a fine cold still morning, with a bright sun, and temperature near the dew-point, persons arriving from the country are pretty sure to find a black fog in town between 10 and 12 a.m. The finest winter days are nearly always very bad ones in London, unless there be any wind between the surface and an altitude of 1000 feet, or the dryness be unusual for the time of year.

When the air is very dry near the surface, no dense fog is formed in London, and when very wet, streaming with fog, in the country, little fog occurs in London. The dry warm surfaces of the houses themselves, and the elevation of temperature above the dew-point, prevents wet fogs from reaching anything like the density they attain in the country. A wet fog disappears under cover, showing its causation by the radiation of its particles towards colder surfaces or space, as well as by mixture of differing air-currents. A dry fog persists to some degree in a warm room, showing it to be largely composed of carbonaceous particles of visible magnitude. There is nothing in the geographical position of London to make it more foggy than many other parts of the country, and, owing to the conditions just mentioned, it would probably rejoice in a clearer air, on the whole, than that of the surrounding districts if ordinary coal were superseded by anthracite and gaseous and liquid fuel.

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[1] Abstract of an Address delivered by the Hon. F. A. R. Russell, on March 1, 1888, under the auspices of the Smoke Abatement Institution.

From the daily tables of weather of the Meteorological Office for 1872, 1873, 1875, 1876, 1877, and 1882, which happened to be in my possession, I have obtained the following results, showing the prevalence of fog at different stations at 8 a m.

The first column (*b*) shows the number of days per cent. of blue sky or free from cloud at 8 a.m., and the second column (*f*) the number of days per cent. when fog more or less prevailed at that hour.

	b.	*f.*
Aberdeen	22	2
Valencia	10·1	2·4
Hurst Castle	13·7	3·2
Leith	11	5·3
Dover	27·9	6
Holyhead	13·2	6·2
Liverpool	12·4	6·6
Pembroke	12	8·5
Scilly	2	10
Oxford	10·4	10·5
Yarmouth	14·5	12·2
London	8	13·5

Aberdeen and Dover have by far the largest number of fine mornings, Aberdeen, Valencia, and Hurst Castle the smallest number of fogs.

The following list, from data of the second order stations of the Royal Meteorological Society, shows the percentage of fogs—that is, the number of days with fog—for eleven stations, during the years October 1879 to September 1882.

	Days of fog.	Notes.
Carmarthen	4·5	No observations in 1880.
Southbourne	4·8	
Ramsgate	5	
Cheltenham	7	
Eastbourne	7·9	Only two years' observations.
Llandudno	8·8	
Babbacombe	14·6	
Hereford	19·1	Only one year's observations.
Croydon	25·9	
Strathfield Turgis	26	
Norwood	34·5	

The following table gives the results of the registration of bright sunshine by glass recorders at seven places in the South of England. The figures give the number of hours of bright sunshine recorded in the four years, 1883, 1884, 1885, and 1886. In the cases of St. Lawrence, Isle of Wight, and St. Leonard's, where data for only two years existed, the result is arrived at by multiplying the value in each case by two. Eastbourne only recorded in 1886, and the result for this year has been multiplied by four. The second column gives the number of hours of bright sunshine in November and December 1885, and January and February 1886.

City of London	3925	62
Kew	5713	222
Greenwich	4845	157
Eastbourne	6660	300
St. Lawrence, I.W.	6774	316
Southbourne	6115	
St. Leonard's	6880	

This absence of light must tell decidedly on the vital force of the community, taken as a whole, and even if we had no dense fogs it would be worth cleansing our atmosphere to get the proper amount of sunshine.

In the great fogs of 1880, the death-rate of London rose from 27·1 for the week ending January 24 to 48·1 for the week ending February 7, which was the period of thickest fog. The death-rate for nineteen provincial towns in this last week was 26·3. At Croydon the rate only rose from 35 to 36. In this period of three weeks from January 24 to February 14, the excess of deaths over the average in London was 2994. Probably ten times as many were ill from the combined effects of smoke and cold. In the week ending February 7, the deaths from whooping-cough were unprecedentedly numerous, 248, and from bronchitis, 1223. Clearly, persons liable to bronchial attacks should if possible keep out of London during winter anticyclones.

The moral reaction of this atmosphere is well worthy of consideration. If smoke were got rid of, there would be a great revival of plant vigour and human gaiety, the housewives who now give up in despair the attempt to keep their houses bright and clean would no longer lose heart, the dull brick walls would begin to deck themselves with colour and ornament, the grime which seems to pervade everything would disappear, and sky and earth would appear in their natural brilliancy.

As the result of a computation taking into account the damage to buildings, furniture, ceilings, wall-papers, works of art of all kinds, the extra washing, and consequent wear and tear, for 4,000,000 people, window-cleaning, waste of coal, extra lighting required, chimney-sweeping, loss of time by artists, &c., impairment of health, and many other items, it appears that the loss by our wasteful method of burning coal must be about £5,000,000 a year.

There are many ways by which householders may economize in the use of fuel. Among them may be mentioned, the use of hot-water pipes and coils at low pressure heated by a coke stove, improved kitcheners, anthracite, patent fuel, mineral oil, and gas. With a reduced price of gas, gas cooking-ranges ought to come into general use. Gas fires throughout a house, except perhaps in one room where an open fire might be kept up, save the following expenses: burning fuel at times when not required, labour and wear and tear in carrying coals, dirt and blackening of ceilings, &c., wood for lighting, sweeping of chimneys, coal-scuttles, fire-irons, emery, and the very considerable amount of domestic labour now taken up by cleaning, laying, and attention generally. Wherever an open coal fire is insisted on, the various improved grates may be employed with great advantage both for economy and smokelessness. Rows of houses could probably be heated economically by hot-water or steam pipes from a boiler in a central position; but the uncertainties of our climate make independent arrangements on the whole preferable. Wasteful ranges might be subject to a tax, which the wasteful householder might be presumed to be capable of paying without inconvenience, and smoky chimneys should not be allowed to pollute the atmosphere with impunity. This would have an effect opposite to that of the tax on light, the window-tax, which vexed the last generation, for it would tend to increase the brightness of London dwellings by the admission of sunlight.

The method of heating water by the arrangement known as the "Geyser" or "Therma" has the merit of utilizing nearly the whole of the heat given off by the gas in burning. This could be employed at the top of the house, the hot water running into pipes in the rooms or on landings, and finally into a cistern in the kitchen, and here, if necessary, an ordinary boiler for heating coils in the upper part of the house or in the hall would utilize the water not yet cooled to the temperature of the air.

The abolition of smoke would certainly effect a very large saving to the community, and would add greatly to the amenity of the climate, not only of London, but of all the adjoining counties. Thousands of acres in the environs could be acquired and turned into gardens with the savings of a single year in the perfect combustion of fuel. In times of distress a sum equal to the wages of 100,000 labourers is now thrown away in the manufacture of an artificially coloured atmosphere. Remedies in accordance with science are at hand; it only remains for society to see that they are applied.

DESICCATED HUMAN REMAINS.

SOME time ago, Signor S. Marghieri, the Mexican archæologist, while exploring the eastern side of the Sierra Madre Mountains in Mexico, at an elevation of nearly seven thousand feet, discovered and explored a hermetically sealed cave. The floor was nearly smooth, the sides rough and rugged, and the vault covered with stalactites. At the far end of the cave, which was of considerable dimensions, four mummified human bodies were found. The bodies—a full-grown male and female, and a boy and girl—were in a sitting posture, hands crossed on the breast, and knees approaching the chin, with the head inclined forward. They were all carefully enshrouded in burial garments, and accurately placed facing the rising sun. We may suppose that the elder male and female were husband and wife. They sat side by side; the elder child, a boy, was placed to the right of the father; the younger, a little girl, to the left of the mother. There was no trace of any implements, utensils, or personal effects; nor were there on the walls hieroglyphics or pictographs. The cave had been sealed by means of sun-dried, adobe bricks, and adobe paste or plaster, together with natural rocks from the mountain. So well was the work done that none but an acute observer would have noticed the artificial closure.

The bodies were brought to San Francisco, and bought by Mr. J. Z. Davis, by whom they were presented to the State Mining Bureau, in the archæological department of which they are now preserved. The following description of them is taken from a careful report drawn up by Dr. Winslow Anderson, for the Board of Trustees of the California State Mining Bureau:—

These naturally mummified bodies differ from mummies proper, in the general acceptation of the term, inasmuch as no embalming process for their preservation was used. They were desiccated in their cave sepulchre by natural elements. The dry hot atmosphere extracted all the moisture from the tissues, and the bodies literally dried up as we would dry jerk-beef, or as the Indians of to-day dry the bison (buffalo) meat which keeps for years.

There is no evidence of these bodies having undergone any preparatory process. The brain, heart, lungs, abdominal and pelvic viscera are all intact and dried to a solid consistency.

The elder male body is about five feet eight inches tall, and well proportioned. The bones are large, and he must have had an excellent physique. He probably weighed between one hundred and eighty and two hundred pounds. All the body now weighs is fourteen pounds.

The integument is well preserved, and presents the appearance of dried hide, or thick parchment, of a dark gray colour, and all that remains between it and the bones are the dried muscles, tendons, nerves, and fascia. The body is well developed, the shoulders measuring from one acromion process to the other, three hundred and ninety millimetres (about fifteen and a half inches); the hands are small, and the fingers tapering; the feet are also small, measuring two hundred and forty millimetres (about nine and a half inches), and highly arched. The phalanges of the digits are perfect, each having the normal number of bones, and the ungual appendages are well preserved and not unusually long.

The body has dried in the sitting posture, hands crossed and knees drawn towards the chin. The cheek and lips on the left side protrude. This probably occurred during the time of mummification; the moisture leaking from the interior of the brain and surrounding tissues, through the cribriform plate of the ethmoid at the anterior portion of the calvaria, through the cribriform foramina into the inferior meatus nasi, and the head being inclined toward the left, produced this bulging from the force of gravitation. Being itself in turn dried up, the mouth maintained its present shape. Short stiff hairs can be seen on the head. The eyebrows and eyelashes are also distinctly visible. A little hair can also be noticed on the upper lip, but very little beard anywhere on the face. The ears are closely pressed against the sides of the head, and only the cartilages remain. The eyes are quite perfect, and present a slight outward obliquity. The nose, originally broad, has been more flattened by the shrinking of the cartilages and the alæ nasi. The lips are stiff and solid, and the tongue is shrivelled to the consistency of cork. There is a full set of masticators in his mouth, thirty-two in number, and all quite well preserved. A few of the dentures only have the enamel worn down to the dentine. The ribs are large and well formed, indicative of a well-shaped chest. The genitalia are well preserved. On the head there has been a large growth of hair, on the face very little, and on the body scarcely any at all.

Owing to the dried integument and fascia covering the cranium, accurate measurements of the skull are well nigh impossible. The following measurements, however, have been made with as much care and accuracy as the subject permitted. The cranial measurements are as follows: circumference, 530 millimetres; length, occipito-frontal, 178 mm.; breadth, bi-bregmatic, 140 mm.; breadth of frontal, 108 mm.; height, 135 mm.; facial angle, 71°.

The sutures and wormian bones cannot be inspected. The malar bones are quite prominent and the lower maxillary and face may be classified with the group orthognathous.

A careful study of this mesocephalic head would indicate that its possessor was of more than average intelligence. The perceptives are well developed. And, although the animal passions undoubtedly predominate, there is enough veneration or religion to class it among the scaphocephalic skulls.

The elder female body is in a better state of preservation than the preceding body. From a measurement of the individual bones, she would be about five feet five inches tall, and weighed, perhaps, about one hundred and fifty to one hundred and seventy pounds. The body weighs, in its present condition, only twelve pounds. The posture, integument, body, &c., resemble the one previously described. The large, oval pelvis, and the once well developed mammæ bear unmistakable evidence of gestation. The hands and feet are small and well shaped; the foot measuring only two hundred and fifty millimetres (about eight and one half inches). On the head is a luxuriant growth of hair, which centuries have not succeeded in destroying. It is very fine in texture, of a dark brown colour, and entirely unlike any Indian hair seen to-day. A curious feature is observed in connection with the small, well-proportioned ears, both of which are perfectly preserved, and that is, in each lobe is worn, even in the stillness of death, a piece of hollow bamboo or reed, about forty millimetres in length, and ten millimetres in diameter. This was probably considered an ornament in her day. The Indians of to-day pierce the helix and antihelix of the ear, through which holes they suspend ornaments of different kinds. The single perforation in the lobe of this mummified woman's ear would indicate a custom observed by her people, similar to the customs in vogue in the more civilized countries, and are not usually observed by Indians of our own period.

The eyes are singularly perfect, presenting a slightly outward and upward obliquity of the external canthi.